Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.20159

# Sulfur dynamics in a riparian peatland subject to seasonal water table fluctuations: implication on soil organic matter mineralization.

**ADRIEN RENAUD**[1,2], VÉRONIQUE DURAND[1] AND CLAUDE MÜGLER[2]

[1]Université Paris-Saclay, CNRS, GEOPS, 91405, Orsay, France
[2]Université Paris-Saclay, CNRS, CEA, UVSQ, Laboratoire des sciences du climat et de l'environnement, 91191, Gif-sur-Yvette, France

Presenting Author: adrien.renaud@proton.me

Peatlands are sensitive environments that rely on a balance between high primary production and waterlogging conditions. Seasonal water table fluctuations, alternating between oxic and anoxic conditions, can significantly impact the biogeochemical processes in such carbon-rich soils. In this study, we investigated the sulfide cycle during a three-year monitoring of a riparian peatland subject to high seasonal variations in its water levels. The method addressed here was multidisciplinary: groundwater sampling every two months for major ions analyses, undisturbed soil sampling to estimate content in organic matter, and high-frequency water table monitoring using pressure probes. We also measured the evolution of the signature of sulfate stable isotopes ($\delta^{18}O$ and $\delta^{34}S$) in the groundwater for one year.

Our results showed a strong correlation between water table depth, sulfate, and bicarbonate, with the same pattern each hydrological year. When water levels are low, sulfate concentrations are low (< 10 $mg.L^{-1}$), and at the opposite, bicarbonate concentrations are high (up to 800 $mg.L^{-1}$). When the water table rises, sulfate concentrations increase rapidly, reaching more than 300 $mg.L^{-1}$ whereas the signature of the nearby river is only 20 $mg.L^{-1}$, while bicarbonate concentrations decrease simultaneously.

We demonstrated that sulfur is recycled within the peatland between reduced and oxidized forms because of seasonal water table fluctuations. Isotopic analyses clearly show the role of sulfide reduction bacteria that use this large pool of electron donors, replenished each year when the water table rises, and accelerate the decomposition of organic matter within the temporarily saturated zone. Consequently, the peatland faces a pedological transformation with organic matter content four-fold inferior above than below the maximum water table drawdown.

Hence, water table fluctuations in peatland can lead to high sulfur concentrations, recycled between reduced and oxidized forms, accelerating organic matter mineralization within the temporarily saturated zone.